UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

June 22, 1978

PROBLEM ANALYSIS

WOOD FOR ENERGY IN THE HOME

4820-FS-NE-4204

by

Jeffrey L. Wartluft
Market Analyst

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
Princeton, West Virginia

U. S. GOVERNMENT PRINTING OFFICE : 1977 O - 251-012

6200-7 (10/73)

PROBLEM ANALYSIS

WOOD FOR ENERGY IN THE HOME

4820-FS-NE-4204

by

Jeffrey L. Wartluft
Market Analyst

Northeastern Forest Experiment Station
Forestry Sciences Laboratory
Princeton, West Virginia

Approved: ______________________ Date: 6/22/78
Project Leader

Samuel F. Gingrich Date: 6/27/78
Assistant Station Director

TABLE OF CONTENTS

PROBLEM ANALYSIS

WOOD FOR ENERGY IN THE HOME

THE PROBLEM

The program of research proposed in this problem analysis addresses itself to two basic problems: (1) The need for dependable and economical fuel for homes, and (2) the need for more efficient utilization of the forest resource--the essence of the Princeton laboratory's mission. Results of the proposed studies should help alleviate both problems.

The Arab oil embargo of 1973 and the harsh winters of 1977 and 1978 caused much concern over supplies and prices of the major sources of energy, fuel oil and natural gas. More households in Virginia and North Carolina use fuel oil than any other fuel; 49 and 62 percent respectively. Natural gas is the most common household fuel in Kentucky and West Virginia, with 58 and 69 percent of households using it (U. S. Dept. of Commerce 1970).

Concern for the high cost of home fuels was reflected in a 1977 study (Professional Builder 1977) of 681 families interested in buying a new home. Study results indicated that 93 percent of the families were willing to pay $600 to $700 extra for an energy

package that would save them $100 in energy costs per year. It also showed that 65 percent of all buyers wanted fireplaces in their new homes.

The No. 2 fuel oil price rose 167 percent from February 1972 to December 1977 (17.5¢ to 49.7¢ per gallon)[1]. About half the fuel oil used in the United States comes from unpredictable and uncontrollable foreign sources. The 6.6 million barrels of oil we import every day is the major contributor to our $25 billion trade deficit (Dun's Review, October 1977).

Estimates of natural gas supplies range from 10 to 1,000 years. At current regulated prices, supplies certainly seem low. In the United States, we are burning natural gas at twice the rate that new sources are discovered (Science News 1977). If gas prices are deregulated, many authorities claim that gas supplies will mushroom. But that is conjecture until it happens.

1/ Ashland Fuel Oil, Princeton, W. Va. 1977. Personal conversation.

Natural gas is the cheapest home fuel on an equivalent Btu basis: delivered to homes, it is $2.05/MM Btu compared with $3.00 for fuel oil, and $10.00 for electricity (Wall Street Journal 1977a). Assuming gas and oil furnaces are 65 percent efficient and electric heaters are 100 percent efficient changes the relative fuel values on a useable Btu basis, but gas remains the cheapest. The Federal Power Commission has granted price increases for interstate gas that are now more than eight times higher than the average 1973 price (Wall Street Journal 1977b).

The major home heating fuels, oil and gas, are both embroiled in so much politics that prices and supplies of either can change drastically on short notice. To quote Dun's Review, "In short, there is no absolute shortage of fuels, but there is a small and diminishing quantity of those available at anywhere near historic prices." (Dun's Review, January 1978).

All of this uncertainty has caused people to consider alternate sources of energy for their homes. Among the alternatives are solar, wind, water, methane, coal, and wood. None of these sources of energy of itself is expected to make a major national contribution in the near future. But the wise use of each can collectively make a large impact in providing home energy.

THE OPPORTUNITY

Large quantities of wood can be utilized for fuel without depleting the resource or disturbing current markets for forest products. This is our opportunity to increase the effective use of our forests by using low grade and waste wood for fuel. The sources of fuelwood are (1) the annual net surplus of growth over harvest; (2) natural mortality in standing timber; (3) wood available from needed timber stand improvement; (4) wood residues from logging and primary processing; and (5) wood not included in forest statistics because it is in trees that occur in fence rows, orchards, small woodlots, backyards, and city streets, or in portions of forest trees less than 4 inches in diameter.

My conservative estimate of surplus wood is 13.6 billion cubic feet (Table 1) or approximately 170 million cords. Assuming the average home burns 5 cords per year (Shelton and Shapiro 1976), this is enough wood fuel to heat 34 million average homes. This is 72 percent of the single family homes in the United States (U. S. Dept. of Commerce 1976).

No matter what the size or form of surplus wood, it can all be used for fuel. In addition to solid fuelwood, fine manufacturing residues like sawdust and bark, and chips produced from small tree parts can be burned with special equipment.

Table 1.--Surplus wood in the U. S.[a]
(millions of cubic feet)

Surplus growth	4,297
Mortality	5,783
Timber stand improvement	645[b]
Unused logging residues	1,899
Unused manufacturing residues	993
Non-reported trees and tree portions	No estimate
Total	13,617

[a] The Outlook for Timber in the United States, 1973, For. Res. Rep. No. 20, U. S. Dep. Agric. For. Serv.

[b] Assume one percent of all poletimber volume to be thinned per year and removal of 1/3 of the volume.

There are additional reasons for considering wood as a home fuel:

- Its supply is renewable, unlike coal, gas, and oil. Good forest management can provide a perpetual supply of wood fuel.
- Wood is locally available in many areas. Some families have their own woodlots or neighbors who will allow cutting for fuelwood. State and National Forests permit controlled cutting for fuelwood. And many forest products companies make residues available for fuelwood.
- Equipment for burning wood is simple and readily available.
- Wood is a clean burning fuel. The products of combustion are the same as those of natural decay--they fit in environmental cycles.
- Users of wood fuel are not inconvenienced by power failures or fossil fuel shortages. One of the common reasons people give for their interest in using wood for home heat is the independence they get from preparing and using their own fuel.
- Wood heat can be economical, particularly for rural homeowners who prepare their own fuel. In my own rural home, I made an investment of $350 in a wood stove and chimney. In a 5-month period the first winter, I prepared fuel from my own woodlot at $12 per cord. Subtracting the fuelwood cost, I saved $90 on my electric bill burning the stove 16 hours a day.

- Public interest in the use of wood for home fuel is indicated by sharply increased wood stove and firewood sales. Stove manufacturers underestimated the demand for wood stoves in 1977. A survey indicated an average delay of 90 days for dealer deliveries. The increase in production over the previous year was 200 percent, allowing an estimate for this year's wood-stove sales (excluding fireplaces and furnaces) of $250 million (Wood Energy Institute 1977). There are over 200 manufacturers of wood-burning equipment.

An example of increased firewood sales was reported by the New York State Forest Fuelwood TSI program. Individuals and dealers pay $2.00 to $3.50 per cord for stumpage and cut their own fuelwood. In 1976, 26,000 cords were sold which is almost as much as the total sold during the period 1928 to 1974 (46 years) (NE For. Exp. Stn. and NE S&PF, December 1976). The Jefferson National Forest has quadrupled the number of free-use permits for firewood issued in the last 3 years. This winter they expect to issue 5,000 permits[2/]. A firewood producer in Potomac, Maryland, built up a business to 1,000 cords in 4 years. This winter he expects to double that amount[3/].

[2/] Bob Boardwine, Timber Staff, Jefferson N. F., Roanoke, Virginia. Personal conversation.

[3/] Pat Ellis, Potomac Garden Center, Potomac, Maryland. Personal conversation.

A growing number of people are using wood to fuel their homes. The use of wood for home heating increased for the first time since 1875 (U. S. Dept. of Commerce 1976, Corder 1973). But there is potential for much more use of wood for home energy.

THE DISADVANTAGES

There are problems associated with harvesting, marketing, and using wood fuel for homes.

Perhaps the most pressing problem is the lack of supply of seasoned fuelwood available to homes. Indications are that the demand for firewood created by the large number of purchases of wood stoves cannot be handled by existing firewood producers, even with recent production increases. For the first time, I saw an ad in our town newspaper (January 19, 1978) by someone wanting to buy a pickup load of firewood. Troop 1 Boy Scouts in Princeton cuts and sells firewood. For the second year, they worked with a constant backlog of 15 pickup loads. The five previous years the highest backlog was five loads. It is difficult to assess either the demand or supply positions of the firewood market since statistics on such are practically nonexistent.

Another drawback is the time needed to season firewood. Achieving efficient combustion and preventing dangerous creosote buildup in chimneys make the burning of dry wood necessary,

particularly in modern air-tight stoves. This aggravates the storage problem, requiring added space and creating an additional burden on the expense of carrying large inventories.

Harvesting firewood is hard work, and can be dangerous. Wood's bulky nature and the fact that trees are dispersed makes it difficult to harvest, process, and market efficiently.

Using firewood requires special precautions. Many homeowners will be installing their own stoves. If unfamiliar with wood burning, they may fail to install and use stoves in a safe and efficient manner. Results could lead to injuries, death, and loss of property. And an increase of fires associated with wood-heated homes can bring on higher fire insurance rates.

THE RESEARCH PROGRAM

We need to solve these problems for harvesters, processors, marketers, and users of wood in order to capitalize on the proven potential and interest of its use in homes for energy. Our research program addresses itself to the solution of some of these problems.

The logical place to apply our research expertise and resources in this problem area is at the fuel supply end. This seems to be the area where the least effort is being made by

other research groups. People are developing and testing new burning equipment for firewood and chips or pellets. Publications are available to guide homeowner harvesting, stove installation, and stove use efforts. The following list of studies is recommended in descending order of priority:

(1) Determine and evaluate present firewood producing and marketing systems, costs, and problems to establish a base for study (2) and thereby improve the supply of fuelwood.

(2) For existing equipment, determine the most efficient and safe harvesting, producing, and marketing schemes. Propose and evaluate new methods.

(3) Determine air-seasoning times for firewood of different species, sizes, and forms (split versus unsplit) to show what conditions give maximum drying with minimum time.

(4) Develop a low cost procedure for accelerating firewood seasoning.

(5) Determine the supply and demand for firewood to show how the market stands.

(6) Develop a guide giving quantities of firewood available from residues and timber stand improvement work to help firewood producers plan their work more efficiently.

(7) Study changes in insurance codes and rates as related to the economics of using wood fuel.

TIME SCHEDULE

I estimate 5 scientist years of work will go into the above studies.

COSTS VERSUS BENEFITS

Using $70,000 per scientist year, the Forest Service manpower costs would be $350,000.

Assuming the potential annual use of wood for home energy in the eastern hardwood region is 30 million cords, and a cord's value as firewood averages $75, the potential annual firewood sales would be more than $2 billion. If our research results help realize this potential, the investment will be fully justified. In addition, improving timber stands through firewood sales will provide a significant benefit.

COOPERATION

The success of this program of research will depend on the cooperation of many groups. Firewood producers and marketers and equipment manufacturers will be called upon for information leading to the development of efficient harvesting, producing, seasoning, and marketing schemes. To keep abreast of developments, we have working relationships with other Forest Service research groups, Forest Service administration, the Wood Energy Institute, and various university staffs. For information on the demand for firewood, we need cooperation from the public. And insurance companies will be called upon for studies of fire insurance rates.

LITERATURE CITED

Corder, Stanley E.

1973. Wood and bark as fuel. Oregon State Univ. For. Res. Lab. Res. Bull. 14, Aug. 1973.

Dun's Review.

1977. The dangerous U. S. trade deficit. Dun's Rev. 110(4):62-69.

Dun's Review.

1978. The energy factor. Dun's Rev. 111(1):61-95.

Northeastern Forest Experiment Station and Northeastern Area State and Private Forestry.

1976. Management Digest, Dec. 1976. Northeast. For. Exp. Stn. and Northeast. Area S&PF, Upper Darby, PA.

Professional Builder.

1977. What buyers say they want in housing in 1978. Prof. Builder 42(13)56-57.

Science News.

1977. Sci. News, Feb. 26.

Shelton, Jay, and Anthony Shapiro.

1976. The woodburners encyclopedia. 155 p. Vermont Crossroads Press. Waitsfield, VT.

U. S. Department of Commerce.

1970. U. S. census of housing, Vol. 1. U. S. Dept. Commerce, Bur. of the Census.

U. S. Department of Commerce.

1976. Statistical abstracts of the U. S. 1976. U. S. Dept. Commerce, Bur. of the Census.

Wall Street Journal, Eastern Edition.

1977a. 1,001 years of natural gas. (Editorial). Wall St. J., April 27, p. 26.

Wall Street Journal, Eastern Edition.

1977b. Intrastate gas. (Letters to the Editor). Wall St. J., July 20.

Wood Energy Institute.

1977. Wood 'n energy, Vol. 2, No. 2. July.